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TITLE: Final Radiological Sampling and Gamma Survey Procedures To Follow Site Remediation of the Former T886 Sodium Disposal Facility.

APPROVALS

Originator: J.J. Collins

RP & HPS: P.D. Rutherford

Facility Manager: R.B. Hardy

Health & Safety: J.E. Burton

Project Manager: Alex Klein 7/25/93

QA: S.E. Reeder 7-26-93

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1.0 SCOPE

This document provides procedures for performing the final radiological survey of the former T886 Sodium Disposal Facility (SDF), following environmental remediation and closure. Included in this procedure are instructions for conducting a walk-about survey for hot spots, and for performing an ambient gamma characterization survey of the site. Analytical techniques to be applied to the data obtained from the survey are also provided.

Instructions for taking surface samples within the remediated areas of the site, are also included, although all sampling will be performed by a contract vendor. An additional comprehensive survey of soil and rock samples from boreholes distributed throughout the site -- for chemical hazards, as well as for man-made radionuclides -- will be performed by an independent contractor, and managed by the RI/RD Environmental Protection Group (D/543). Procedures for the borehole survey will be provided by the contractor, and are NOT included here. RI/RD RP&HPS will use the sample analysis data to perform a pathways exposure analysis.

The location of the SDF site within Santa Susana Field Laboratory (SSFL) Area IV is mapped in figure 1. A description of the SDF site, and the technical approach that was carried out in the remediation and closure are contained in reference 1.

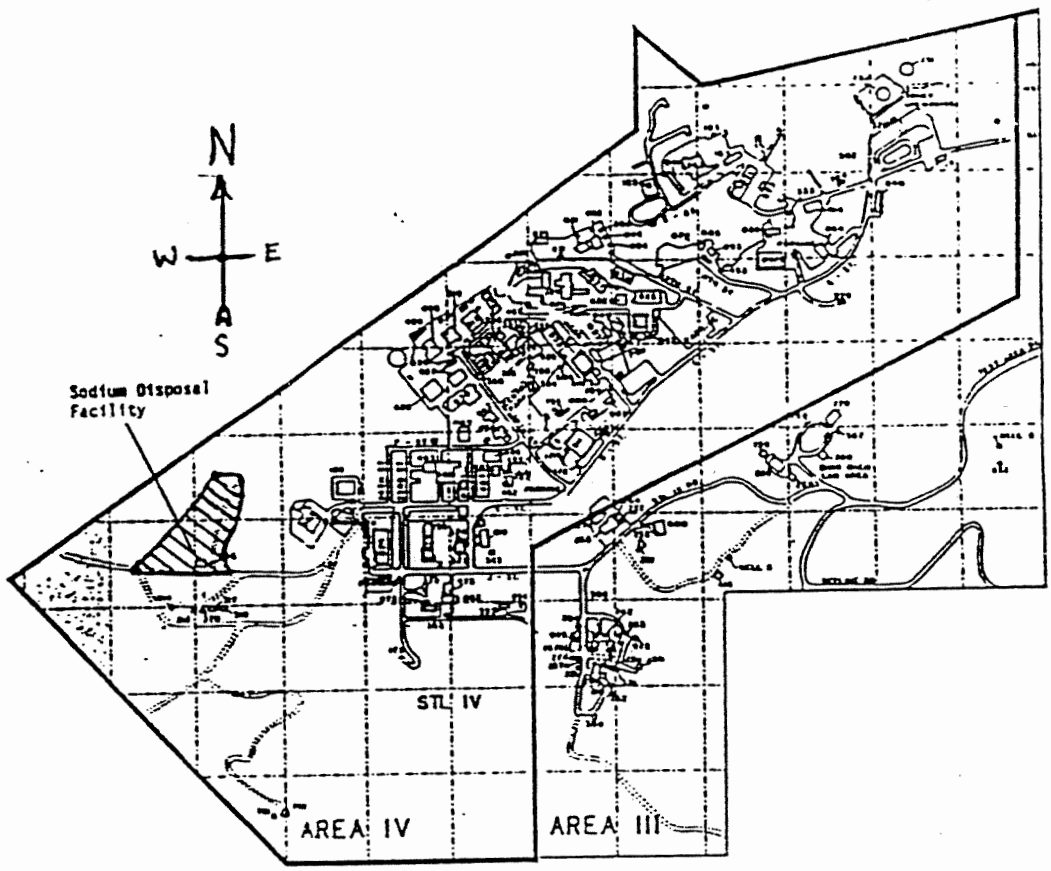

Figure 1. SSFL Area IV map showing location of the SDF site.

1.1 PURPOSE OF THE SURVEY

The purpose of this radiological survey is to confirm, after site remediation has been completed, and before backfilling with imported soil, that radioisotope contamination products at the site do not exceed levels that are acceptable for release without radiological restrictions.

1.2 EXPECTED OUTPUT.

All survey data will be tabulated by location on the SDF site coordinate grid, relative to a surveyor's brass monument located at the site. All survey records, procedures, data, and related reports for this final radiological survey will be maintained in the T886 Site Radiological History File by the RP&HPS group. A table of the data locations will be cross-referenced to **Northing** and **Easting** coordinates on the California Plane Coordinate System (as determined in reference 2), and inserted into the historical file.

The ambient gross gamma activity measurements made during the final radiological survey will be converted into exposure rate units and compared to normal background. This comparison will verify that all measurements are less than 5μR/hr above the nominal background radiation level for the area, which is the limit recommended as acceptable for release without radiological restrictions in reference 3.

A soil sample survey of the former T886 Sodium Disposal Facility and its surrounds will be done separately by a contract vendor to determine what isotopes, if any, are still present after site remediation. Using US DOE's Residual Radioactive Material Guideline (RESRAD) analysis program to perform an environmental pathway analysis, RI/RD will determine appropriate guideline limits for the fractional concentrations of any radioisotopes found in the soil sample survey. RI/RD RP&HPS will then determine that none of the radioisotope concentration data from the sample survey analysis exceedes the calculated guidelines. Finally, the sample data will be used in a RESRAD analysis to estimate the radiation dose that could occur from the site from any residual radioisotopes still present. The resulting value must be less than 10 mrem/yr.[ref 3]

Sufficient data will be collected to assure that the site qualifies for release to unrestricted use without radiological restrictions, and that a request can be made of US DOE to remove the RMMA designation from all portions of the site. If any survey locations are found to exceed the stated radiological criteria limits, those locations will be referred back to the Program Manager for additional soil or bedrock sampling, and for further remediation, as needed. All such findings will be listed on a separate table, and marked on a site map.

The end product of the work covered by this procedure will be a final report containing the peak activity location data from the walkabout survey, along with the ambient 1-meter gamma radiation levels recorded during the final site characterization survey. The report will also contain the analytical results from the contract vendor's surface samples, and the comprehensive borehole sample survey, together with the measured borehole and surface gamma radiation levels at the sample locations. Finally, the results of the RESRAD pathway analysis will be presented, along with the data inputs used to base the calculations. All site data will be tabulated by SDF location coordinates, and plotted on site location maps.

3.0 EQUIPMENT AND MATERIALS

3.1 SURVEY EQUIPMENT AND MATERIALS LIST:

Required for Gamma Surveys:

3 ea. Ludlum Model 2221 or Model 2220-ESG Scaler/Ratemeters
3 ea. Ludlum Model 44-2 High-Energy NaI Gamma Detectors
Grid Survey Gamma Detector Fixture (see para 3.2.1)
2 ea. Walk-About Gamma Detector Fixtures (see para 3.2.2)
Field Check Source (low-level ^{137}Cs calibration source)
2 ea. Sighting Compasses (Silva Type 27 or equivalent)
3 ea. 200 ft (minimum) Fiberglass Field Survey Measuring Tapes
3 doz Wire stakes (w/ iridescent yellow flags)
Survey Log Book (w/ Bound and Numbered Pages)

Required for Obtaining Surface Bedrock Samples:

6 doz (clean) 500ml Beakers, with Lids
6 doz Plastic Sample Bags
6 doz Sample Labels
6 ea. *Rad-Analysis Request & Chain-of-Custody Record* forms
Plastic Tape, Black Marking Pen
Hand Trowel
Geologist' Sledge Hammer
Geologist' Chisel
Geologist' Gad-pry Bar
Safety Glasses
Face Shield

3.2 PRESURVEY DETECTOR HARDWARE PREPARATION

3.2.1 Grid Survey Fixture

For the grid survey, the two sodium-iodide gamma detectors will be mounted on a special fixture that holds the detectors side by side at 1-meter distance from the ground surface during the measurement. This fixture, the ***ambient gamma survey fixture*** is described in Appendix §A.1.

3.2.2 Walk-About Survey Fixture

For the walk-about survey, each sodium-iodide gamma detector will be mounted at the end of a balanced boom that can be held at a few inches distance from the ground surface, and swept side to side during the survey. Two of these special survey fixtures will be available for the walk-about survey, so that both gamma detectors can be deployed by the team at the same time. The ***walk-about survey fixture*** is described in Appendix §A.2.

4.0 SPECIAL SAFETY PRECAUTIONS

This survey is to be performed after the hazardous and radioactive materials contamination have been removed from the survey area. Nevertheless, some hazards may still remain at the site.

The SDF site is located in a remote area that is known to be home to rattlesnakes, scorpions, black widow spiders, ticks, and other biting creatures. The survey team is therefore cautioned to refrain from stepping into or near small caves or cavities under rocks, natural depressions, or small animal holes. Similarly, do not put hands or fingers in any place that has not been visually inspected.

Thick stands of Poison Oak grow throughout the area, and people who have particular sensitivity to the oil produced by the leaf of this plant should avoid contact with it. Note that, on contact with the plant leaves and stems, the irritation-producing leaf-oils may by transferred to other surfaces, such as the survey detector fixture, which can then become secondary sources for skin contact.

Particular attention to eye safety should be excercised when obtaining chip samples from the sandstone bedrock using a hammer and chisel. Be sure that the hammer and chisel selected for this work is made for geological applications. When collecting chip samples the employee shall wear a face shield and safety glasses. During chipping and boring activities, special attention shall be given to note discolorations and/or odors in the newly exposed rock or soil. If conditions change, work shall stop immediately, all personnel will be cleared from the area, and the site HSO will be notified. The site HSO will then evaluate the conditions and adjust personal protective equipment requirements accordingly.

Due to past excavations and newly exposed bedrock, much of the area is comprised of uneven terrain, which presents a tripping and falling hazard to the crew. Since this risk is made worse when carrying bulky equipment (such as will be used during this survey), the team will always have at least two members present.

Before site remediation, the principle non-natural hazards at the SDF worksite included possible inhalation of vapors from residues of petroleum products and industrial solvents, and possible inhalation of dust particles containing residues of heavy metals and alkali metal oxides, asbestos fibers, and radionuclides. Since this survey is being performed after the soil containing all of the hazardous materials has been removed from the site, special chem-hazard protective outerwear or breathing equipment will not be needed while performing this final radiological survey procedure.

4.1 PERSONNEL PROTECTIVE EQUIPMENT

Only general work hazard protection will be needed during this survey: Hard hats, Steel-toed high-top workboots, Safety glasses, Face shield, and Gloves.

The Site Safety Officer and each individual survey team member are mutually responsible to insure that each person has been advised of, and is supplied with, correct protective equipment before the team enters the site.

The SDF Site Health and Safety Officer (HSO) will immediately brief the survey team about any changing conditions that may require special precautions, additional protective equipment, or temporary suspension of work.

4.2 SPECIAL PERSONNEL TRAINING REQUIREMENTS

Members of the radiological survey team must have completed the following training courses before entering into the site work areas:

Hazardous Waste Operations and Procedures Course
[24-Hour course (4033/24), or, 40-Hour course (4033/40)]
T886 (SDF) Site Familiarization Course (5010)
Hazardous Materials Communications Course (4010)
Radiation Safety Training Course (2013)

Additionally, all survey team members:

Must have 8-hours on-site on-the-job training, which may be concurrent with the survey;

Must have had a medical qualification exam and be currently on an annual medical monitoring program for radiation, mercury, and lead;

Must be familiar with the site H&S Plan, and be aware of the nature of the hazards that were present at the site before site remediation;

Must read and understand the radiological survey procedures detailed in Section §5 of this document;

4.3 SITE ACCESS CONTROLS

At the start of the survey, the Facility Manager will initiate and sign a Controlled Work Permit (CWP). Specific procedural or protective requirements appropriate for the working conditions at the site will be defined by the HSO, and listed in the CWP. Each survey team member will sign the CWP.

At the start of each work shift, all survey crew members must sign in at the site Engineering Trailer, and check in with the Facility Manager or the Site Crew Chief before entering the work area. The HSO, Facility Manager, or Person In Charge (PIC) will brief the survey team on current site hazards, and on changes to specific procedural or protective equipment requirements that may be needed in the work area.

4.4 SDF HEALTH AND SAFETY PLAN

The site Health and Safety Plan (H&S Plan)[ref 4], for the Sodium Disposal Facility remediation and closure, contains detailed information on the specific hazards that existed at the site before remediation, on the associated protective equipment that was needed in the presence of those hazards, and on the procedures governing all of the work done at the site during remediation. Since the purpose of the T886 remediation project was to remove all non-natural material, chemical, and radiological hazards from the site, it is expected these hazards are no longer present. Nevertheless, because this final survey is being done to verify that the hazards were effectively removed during the site remediation, each person on the radiological survey team should become familiar with the T886 remediation and closure H&S Plan. A copy of the H&S Plan is kept in the site Engineering Trailer for ready access and referral.

5.0 WORK INSTRUCTIONS

This section provides detailed working procedures for performing the final surface sampling and gamma radiological survey of the Sodium Disposal Facility ponds, and adjacent areas. After a brief description of the overall survey plan, detailed instructions are given for determining survey locations, followed by specific procedures for performing the surface sampling, and gamma surveys.

Procedures for correct operation of the survey instruments; for survey instrument quality assurance; and for survey data identification and record keeping are given in Appendix B.

During performance of this work, a single designated working copy of this procedure will be utilized at the work site. Should procedure changes become necessary during the survey, the working copy will be redlined to reflect the changes. All changes to procedures must be approved by the Facility Manager. Radiation Protection and Health Physics Services must approve and sign any changes affecting radiological health and safety, or survey methodology, and the Project Manager must approve and sign any changes affecting cost or schedule. Quality Assurance must also approve and sign any changes. At the completion of the survey, all redlined changes will be incorporated into a revised version of this procedure, and released through ETEC document control.

5.1 SURVEY PLAN OVERVIEW

This section provides a brief description of the overall plan for final radiological survey of the Sodium Disposal Facility.

The final survey will consist of four parts: a walk-about survey of near-surface gamma activity over the whole site; a characterization survey of ambient gamma activity at 1-meter above the surface, at locations defined by a 10-ft measurement grid overlaying the whole site; Surface bedrock sampling and surface gamma survey measurements within the excavated area of the facility, to be done by a contract vendor, at locations defined by a random selection process; and a comprehensive survey of soil and bedrock samples, together with measurements of 1-meter ambient gamma, surface gamma, and borehole gamma from boreholes at randomly selected locations distributed throughout the site (also to be done by a contract vendor).

This procedure provides detailed instruction for conducting the walk-about survey of near-surface gamma activity, and for performing the 1-meter ambient gamma characterization survey. Sampling locations, equipment requirements, general procedures, and some special work precautions are also included for the surface bedrock sampling to be done in the excavated area, even though this work will be carried out by an outside vendor. Selection of

sampling locations and the development of instructions for the borehole soil/bedrock sample survey of the surrounding non-excavated areas are NOT covered in this procedure; The vendor is expected to select randomized locations independently, and to supply procedures appropriate for safe operation of their own heavy equipment.

Before any baseline survey or remediation work was started at the former Sodium Disposal Facility, location stakes on a 50ftx50ft interval grid were established throughout the site. All of these grid locations were referenced to a surveyor's brass monument located east of the site.[ref 2]. This monument marks a location on the California Plane Coordinate System [note 1] at:

N266,309.97
E1,783,273.69

During the site cleanup, many of the marked 50ft grid locations were lost either in the excavation to bedrock, or were displaced by the work activities; The 50ft grid reference locations will therefore have to be re-established at the begining of this survey, using the field survey measuring tapes and sighting compasses. At locations where the bedrock is exposed, an alternative to marker stakes may have to be used (such as marker ducks, or tall survey marker nails driven into the rock surface). Once this is accomplished, the individual sample/survey locations for this survey can be found by measuring the distance (in terms of [North/South, East/West] coordinates) to the 50ft grid reference markers bracketing the point of interest.

To identify a sample/survey location in terms of rectangular coordinates from the site location grid, the survey team will lay measuring tape lines between east/west grid reference stakes just north of, and just south of the location being surveyed. Using a third measuring tape, running north/south (perpendicular) between the first two tapes, and through the sample/survey location, the survey team will then be able to determine the [N/S,E/W] coordinate point for the sample in terms of the site location grid. For the 1-m ambient gamma survey, the radiological survey measurements will be made at the 10ft interval intersections of East/West, and North/South grid lines superimposed upon the 50ft site location grid. When the measurements are recorded, the sample/survey location will be identified by its rectangular coordinates on the site location grid (written in brackets), which in turn establishes the location as a distance E/W, and N/S of the site reference marker.

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note 1: The referenced brass surveyors' monument was placed in 1975 to mark the location as 22,010ft north of, and 10,120ft east of a locally selected survey reference point. The relationship of the brass monument to the California Plane Coordinate System was established in the survey documented by reference 5.

For example:

If the brass monument is reference point [0,0], a survey location identified by the rectangular coordinates [S220,W180], would be found at a point that is 220 feet south of the monument and 180 feet west of the monument.

To assure future traceability, a listing of the measurement locations will be converted to **Northing** and **Easting** coordinate points on the California Plane Coordinate System, and inserted as a table in the historical file for this project.

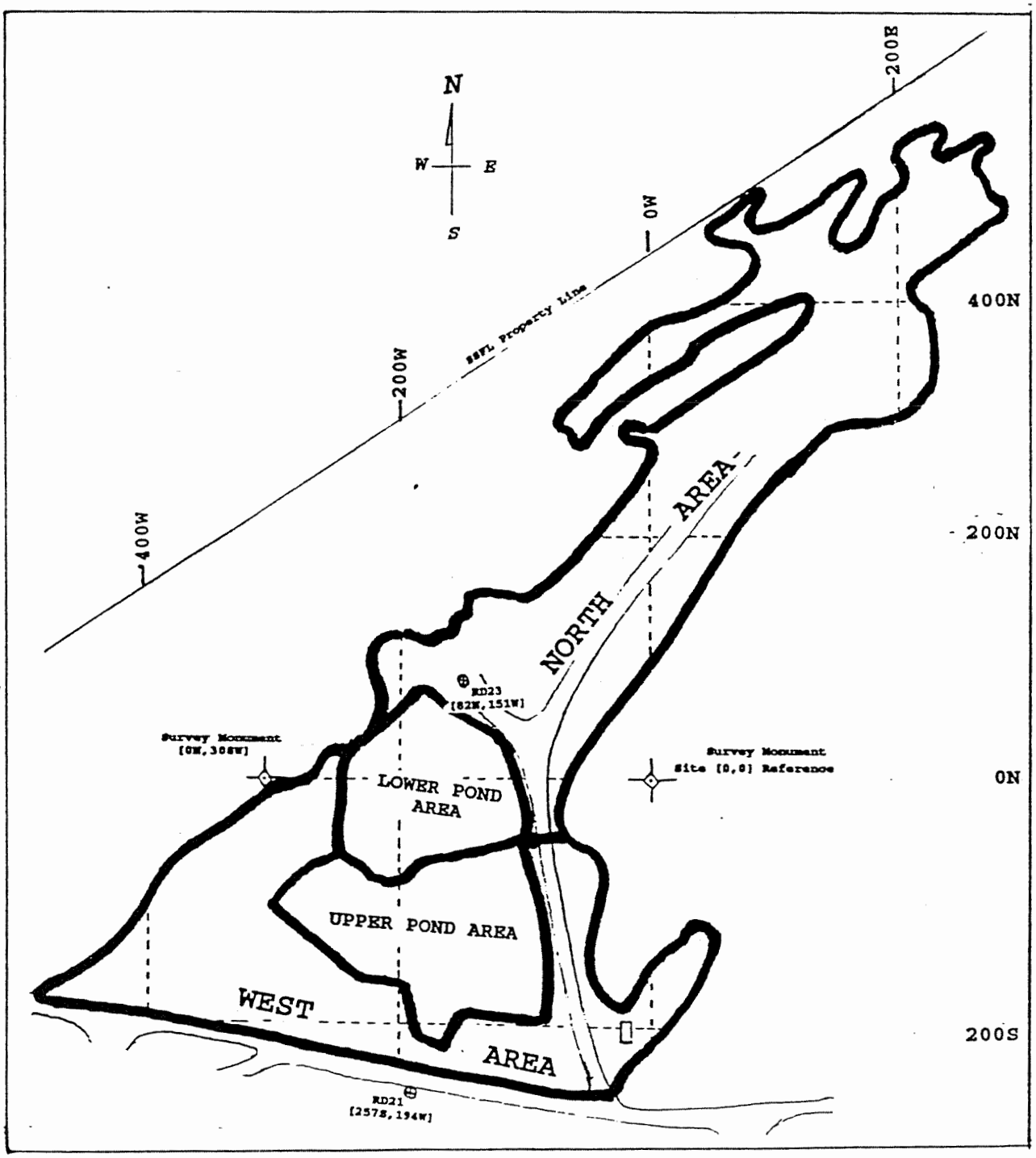
This sample location and labeling scheme provides permanent traceability of the physical location of each survey point into the future without need for individual marker stakes or monuments, and regardless of the site modifications that occur in the future.

During the SDF Site Remediation Project, four seperate facility areas were individually recognized:

Lower Pond Area	(northernmost pond area)
Upper Pond Area	(southernmost pond area)
West Area	(area west of the ponds)
North Area	(areas north, and northeast of the ponds)

A map of the SDF site showing the relative locations of the four areas is given in figure 2. Note that, for the final survey, the Lower Pond Area now includes it's adjacent containment berms (all excavated); the Upper Pond Area now includes it's adjacent containment berms, plus some remediated areas west, and southwest of the upper pond (also all excavated); the West Area now includes non-excavated areas south and southeast of the ponds; and the North Area now includes the non-excavated downslope area north of the site to the property line.

Figure 2. T886 Final Radiological Survey -- SDF Site Map Showing Locations of the Four Major Facility Areas.



For statistical management of the sampling survey, a distinction is made between **remediated areas** (where contaminated soil was removed by excavation), and **non-remediated areas** (where no contamination was found, and no excavation was needed or done). The remediated areas are divided into the Lower Pond Area (Lot II), and the Upper Pond Area (Lot III). All of the non-remediated areas, including the remaining portions of the West Area and the North Area, are grouped into Lot I.

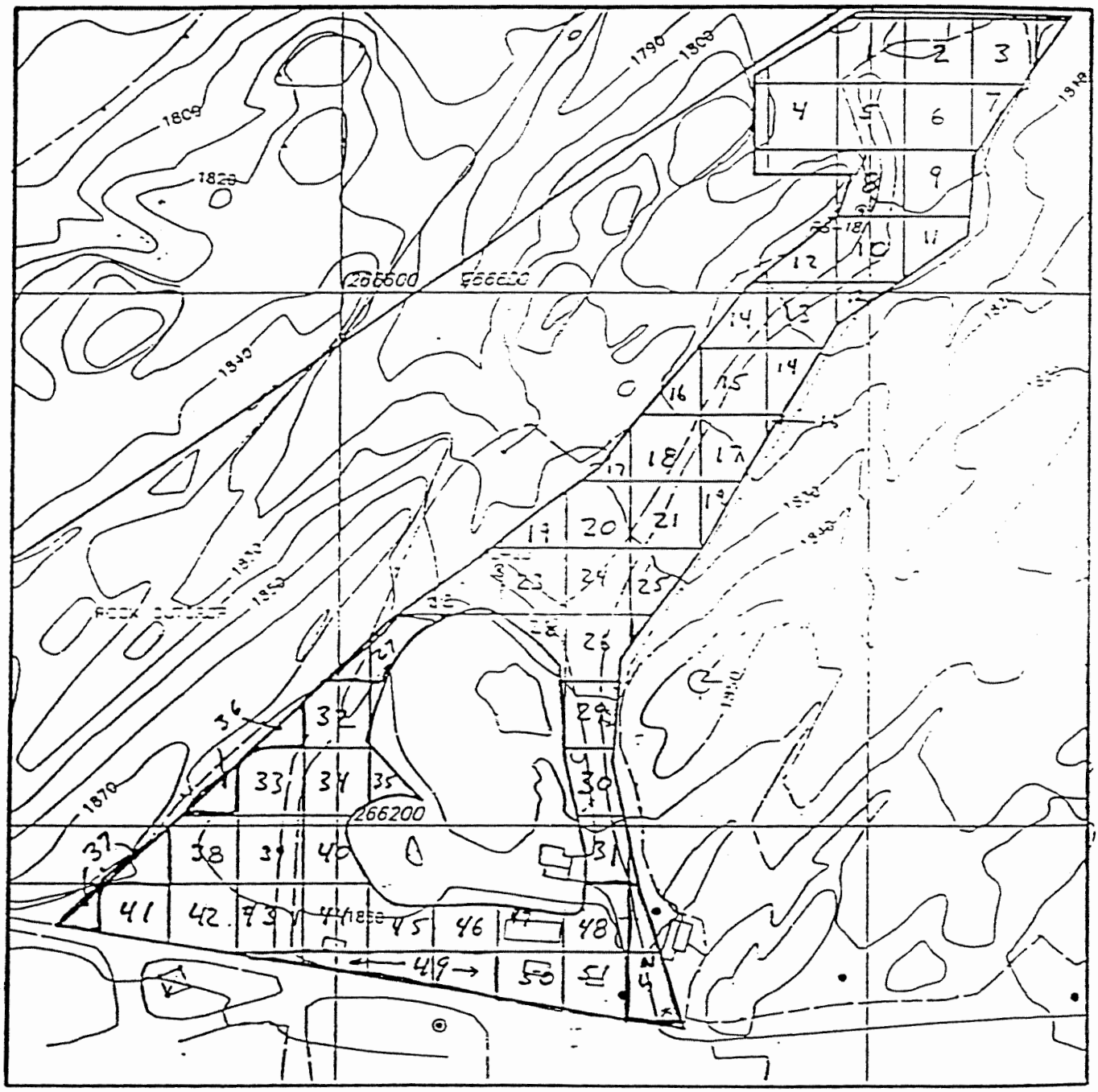
All of the soil/bedrock sampling will be performed by an outside vendor, under management of the RI/RD Environmental Protection Group (D/543). The following description of the sampling program is provided for information only.

Lot I -- Surface and borehole samples from the area surrounding the Sodium Disposal Facility, outside of the facility area excavated for remediation. Lot I is divided into 52 sampling areas, each about 2500 square feet in size, with the area boundaries defined approximately by the lines of the 50ft x 50ft Site Location Grid. The 52 sampling areas of Lot I are mapped in figure 3. One set of surface and borehole samples will be taken from a randomly selected location within each of the 52 sampling areas. The specific sample location within each of the sampling areas will be determined by the outside contractor by a randomizing process, as specified in reference 6.

Lot II -- At least 30 surface bedrock samples from the excavated area formerly occupied by the Lower Pond and adjacent lower pond berm. Lot II is divided into a 10ft by 10ft square grid for the ambient gamma characterization survey. Each 10ft intersect on the grid will be assigned a number and entered into a lottery. Thirty (30) of the intersect locations will be randomly selected in the lottery, and samples will be taken at each location drawn. Specific Lot II sampling locations are given in section §5.2.3.1.

Lot III-- At least 30 surface bedrock samples from the excavated area formerly occupied by the Upper Pond, the adjacent upper pond berm, and an adjacent area west of the ponds. Lot III is divided into a 10ft by 10ft square grid for the ambient gamma characterization survey. Each 10ft intersect on the grid will be assigned a number and entered into a lottery. Thirty (30) of the intersect locations will be randomly selected in the lottery, and samples will be taken at each location drawn. Specific Lot III sampling locations are given in section §5.2.3.2.

Figure 3. SDF Site Map Showing Locations of Lot I Sampling Areas.[ref 6]



Each individual surface sample location will be identified by its location on the site location grid. The sampling tools will be wiped with a damp rag, or laboratory wipe, after each sample is taken so as to minimize cross contamination of samples. Proper sample packaging and Chain-of-Custody record keeping will also be observed[ref 7] to insure the integrety of the sample ID.

The walk-about survey of near surface gamma activity will be an active search for peaks (or hot spots, if any) in gamma countrate as the survey team walks over the entire site. During this survey, the survey team will generally walk along the east/west grid lines (decrementing at ~10-foot intervals with each completed transit across the site) while listening for changes in meter click rates. If an activity increase is noticed, the surveyor will follow the direction of the increase until the location of the peak is found. The gamma detector will be mounted on the end of a balanced boom, with which the surveyor can hold the detector close to the ground surface while sweeping it side to side as he/she walks. The countrates of any gamma activity peak or hot spot finds will be recorded, and the locations identified by reference to the site location grid.

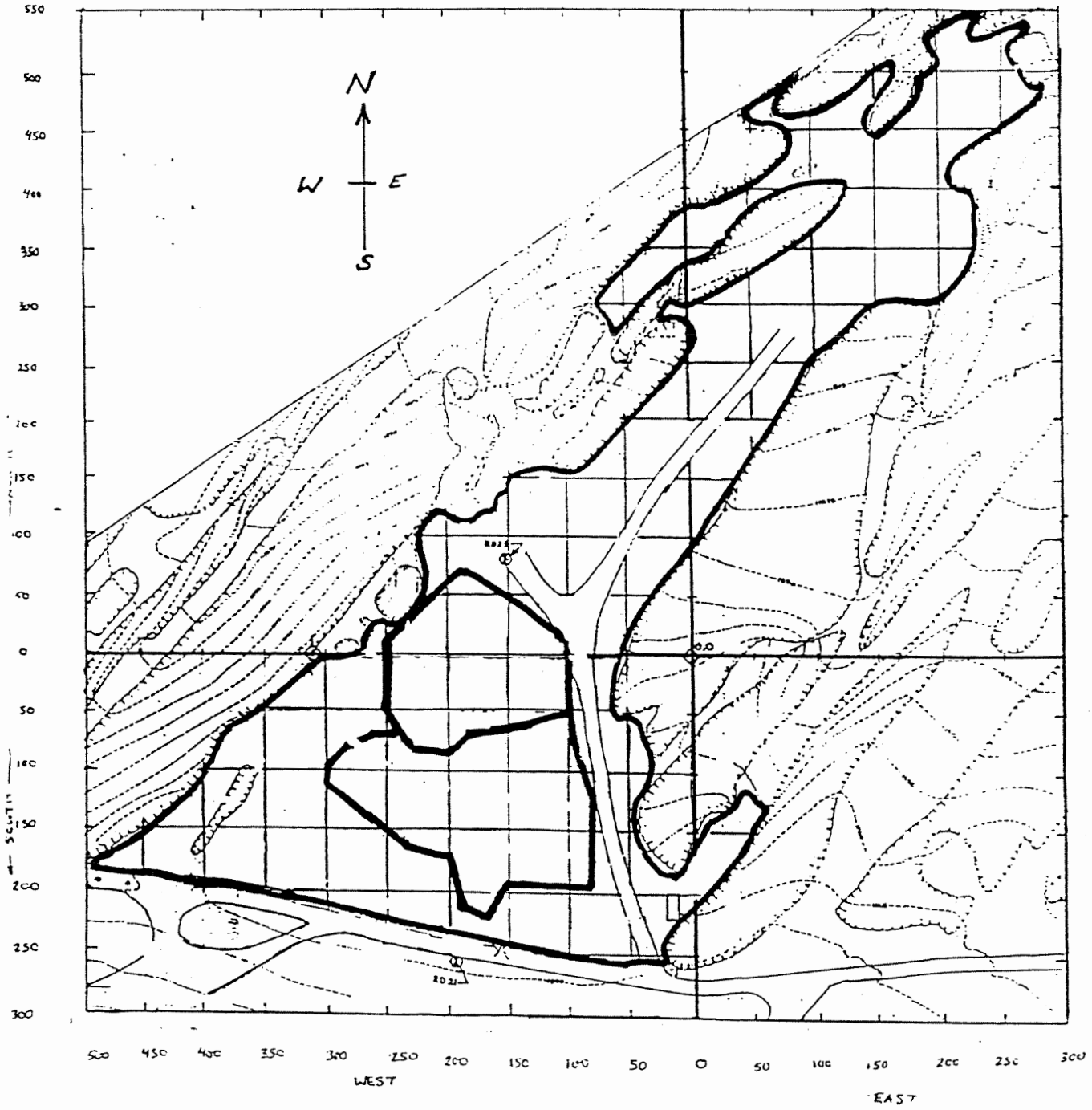
Any location where a peak occurs in gamma activity greater than about 523 cpm (counts/min) over the normal background (at 1-meter height) will be marked with a flag; the Survey Manager will evaluate the finding, and determine if the activity is related to the natural geology of the area. If the activity at the peak location is not due to natural geology, the Survey Manager will notify the Facility Manager and Project Manager for further direction.

If any location is shown to have a peak in gamma activity that **exceeds** the exposure rate criteria level of <5μR/hr above normal background (ie: having gamma activity greater than about 1075 cpm above normal background at 1-meter height), the survey team will determine the extent, or boundary of the hotspot, and mark the boundary with a flag; the survey team will notify the site crew chief or facility manager about the hotspot before the end of the shift.

For the ambient gamma characterization survey, the individual survey points will be spaced at 10-ft intervals along both the north/south and east/west directions.[ref 8] The survey grid will overlay the same grid pattern established during the baseline beta/gamma survey of the site.[ref 9]

The ambient gamma survey measurements at each survey location will consist of 1-minute measurements of gross gamma at 1-meter distance from the soil surface.[ref 10] All measurements will be made simultaneously with two gamma meters. All data will be labeled by location, and recorded on a Survey Data Control Sheet according to the instructions provided in Appendix B.

Figure 4. T886 Site and Surrounds:
Final Radiological Survey Area Schematic,
with 50ftx50ft Site Grid Layout.



5.2.1.1 Establish the Baseline East/West Location Axis

Starting at the surveyor's brass monument at the site reference point (location [0,0]), find the first 50ft grid marker stake to the west (location [0,W050]). Starting at this first stake, lay a 200-ft measuring tape along the line of stakes running due west of the brass reference monument; the measuring tape 200-ft mark should fall on the [0,W250] 50ft grid marker stake. Leaving the first measuring tape in place, find the 50ft grid marker stake at [S200,W050] -- that is, 200 feet south, and 50 feet west of the reference brass monument. Lay a second 200-ft measuring tape along the line of stakes running due west of stake [S200,W050]; the 200-ft distance mark of the second measuring tape should fall on the [S200,W250] grid marker stake. A specific location along either of the two east/west tape lines is found by adding the distance value along the measuring tape to the "west" site location distance value on the 50ft grid marker stake being used as a starting point.

For example:

A location on the first measuring tape at the 70-ft mark (i.e., 70ft west of the tape starting point) would be equal to w70 + [0,W050] = [0,W120], which describes the location as being 120 feet due west of the reference monument.

Similarly:

A location on the second measuring tape at the 70-ft mark would be equal to w70 + [S200,W050] = [S200,W120], which describes the second location as being 200 feet south, and 120 feet west of the reference monument.

Note that a north/south line, running from the 70-ft mark on one tape to the 70-ft mark on the second tape, lies along the W120 Site Location Grid axis.

5.2.1.2 Establish the North/South Location Axis

Lay out a third 200-ft measuring tape running on a north/south line between the W120 (Site Location Grid) axis points of the first and second tape lines. A specific survey location along the north/south axis can now be determined by adding the distance indicated on the measuring tape to the North (or South) distance coordinate value on the 50ft grid marker stake being used as a starting point. The total distance North (or South) of the brass reference monument describes the location of the North/South coordinate point for the survey location.

For example:

A location on the north/south coordinate axis at the 180-ft tape mark (i.e., 180 feet south of a starting point that is 120 feet due west of the brass reference monument) would be equal to s180 + [0,W120]=[S180,W120].

5.2.2 10ft INTERVAL GRID (CHARACTERIZATION) SURVEY LOCATIONS

Once the positions of the marker stakes (or marker ducks) for the 50ft x 50ft Site Location Grid have been verified or replaced (§5.2.1), they can be used directly for determining the 10ft x 10ft interval grid locations.

5.2.2.1 Starting at a 50ft grid location stake on the northeast corner of the area to be surveyed, lay a 200ft measuring tape along the line of stakes running south of the starting point. Leave the tape in place. This tape will be referred to as the *east boundary tape*.

5.2.2.2 Move to the 50ft grid location stake 200ft (or, to the grid location stake marking the edge of the survey area) due west of the starting point. Lay a second 200ft measuring tape along the line of stakes running south. Leave the second tape in place. This tape will be referred to as the *west boundary tape*.

5.2.2.3 Return to the starting point at the northeast corner, and lay a third 200ft measuring tape along the line of stakes running due west to the second tape. Leave the third tape in place. This tape will be referred to as the *survey transect tape*.

5.2.2.4 The survey measurement locations for the ambient gamma characterization survey are at the 10ft interval marks along the length of the third tape -- the *survey transect tape*. The location of each survey point must be identified in terms of its location on the SDF Site Location Grid, by adding the tape distance to the site coordinants of the starting point marker stake (as described in §5.2.1.1).

5.2.2.5 When survey measurements are complete along the length of the *survey transect tape*, make sure that the *east* and *west boundary tapes* are still in place and stretched tightly. Using the distance scales on both the *east* and the *west boundry tapes*, move the *survey transect tape* 10ft southward. Repeat §5.2.2.4 to find the next set of survey measurement locations.

5.2.2.6 Repeat §5.2.2.4 and §5.2.2.5 until the survey is complete.

5.2.3 SURFACE SAMPLE SURVEY LOCATIONS WITHIN REMEDIATED AREA[note 2]

The remediated areas of the SDF site are divided into two sampling lots: Lot II, for the Lower Pond Area, and Lot III, for the Upper Pond Area. Since site remediation included removing the contaminated soil to bedrock, surface samples within the remediated area will consist of residual soil or rock chips broken off of the bedrock surface. All sampling will be performed by the sampling contract vendor. For each sample lot, two additonal duplicate samples will also be taken for quality assurance.

5.2.3.1 Lot II -- The samples for this survey lot will consist of residual soil, or rock chips from the bedrock surface, along with measurements of surface gamma, and 1-meter ambient gamma activity, from the 30 locations listed in Table 1. These locations were randomly selected by lottery from the 10ft interval grid intersects (of the SDF Site Location Grid) that fall within the Lower Pond Area. A schematic map of the area, showing the Lot II sample locations, is given in figure 5.

Table 1. Proposed Lot II Surface Sample/Gamma Survey Locations:

[60N,200W	[30S,210W]
[50N,210W]	[30S,200W]
[50N,190W]	[30S,180W]
[20N,150W]	[30S,140W]
[20N,120W]	[40S,230W]
[10N,190W]	[40S,220W]
[10N,170W]	[40S,100W]
[10N,110W]	[50S,240W]
[0,100W]	[50S,180W]
[10S,240W]	[50S,140W]
[10S,180W]	[50S,120W]
[10S,160W]	[60S,230W]
[20S,150W]	[60S,200W]
[20S,140W]	[70S,220W]
[30S,220W]	[80S,210W]

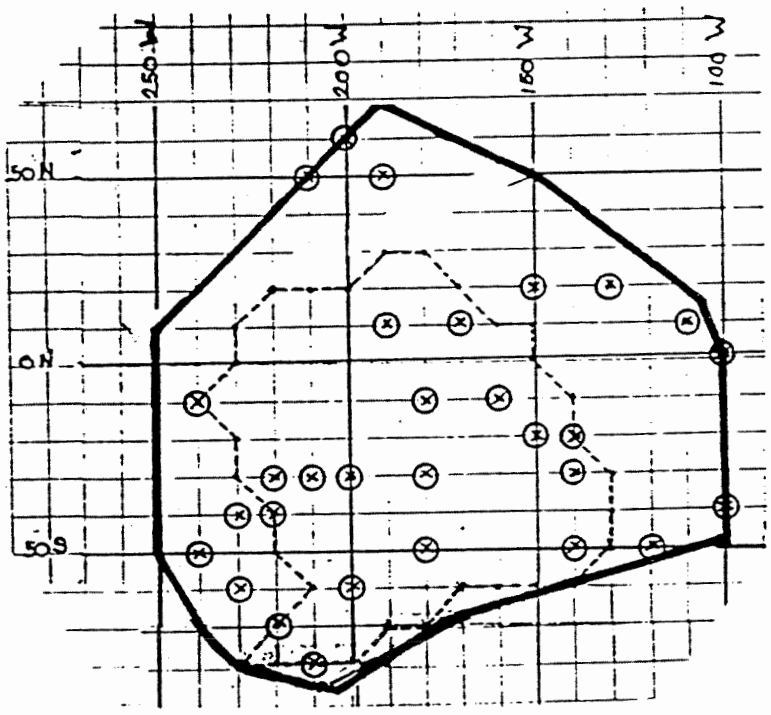


Figure 5. Lower Pond Area Schematic Showing Lot II Sample/Survey Locations.

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note 2: Sample locations for Lot I (non-remediated areas) will be determined by the contract vendor. Refer to §5.1 and figure 3.

5.2.3.2 Lot III -- The samples for this survey lot will consist of residual soil, or rock chips from the bedrock surface, along with measurements of surface gamma, and 1-meter ambient gamma activity , from the 30 locations listed in Table 2. These locations were randomly selected by lottery from the 10ft interval grid intersects (of the SDF Site Location Grid) that fall within the Upper Pond Area. A map showing the sample locatons of the Lot III sample survey area, is given in figure 6.

Table 2. Proposed Lot III Surface Sample/Gamma Survey Locations:

[60S,120W]	[90S,150W]	[110S,160W]	[140S,140W]	[170S,190W]
[70S,250W]	[90S,140W]	[120S,220W]	[150S,200W]	[170S,140W]
[70S,160W]	[100S,290W]	[120S,190W]	[150S, 80W]	[180S,180W]
[80S,170W]	[100S,230W]	[130S,240W]	[160S,210W]	[180S,130W]
[90S,230W]	[100S,200W]	[140S,210W]	[160S,170W]	[180S,100W]
[90S,170W]	[110S,220W]	[140S,180W]	[160S, 90W]	[190S,180W]

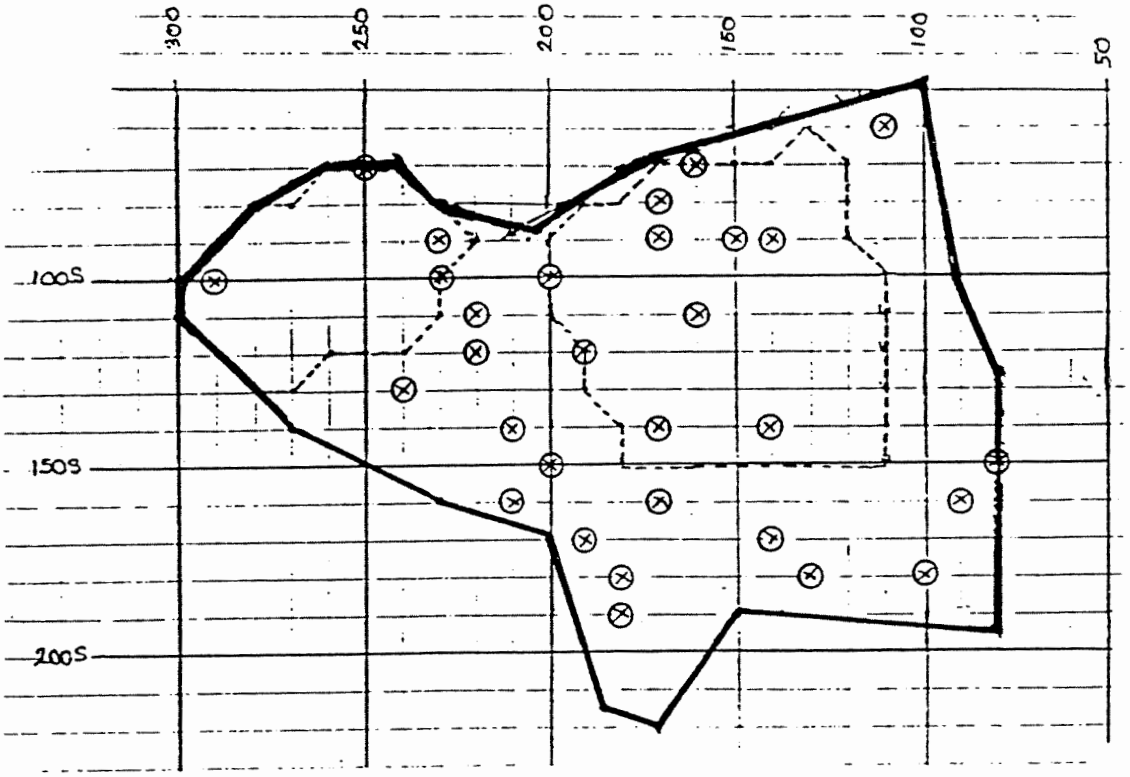

Figure 6. Upper Pond Area Schematic, Showing Lot III Sample/Survey Locations

5.3 SURVEY/SAMPLING INSTRUCTIONS

5.3.1 WALK-ABOUT SURVEY INSTRUCTIONS

The walk-about survey of near surface gamma activity will be an active search for peaks (or hot spots, if any) in gamma countrate, as the survey team walks over the entire site. The gamma detector will be mounted on the end of a balanced boom, with which the surveyor can hold the detector close to the ground surface while sweeping it side to side as he/she walks ahead (see Appendix §A.2 for details about the *Walk-About Survey Detector Fixture*).

Starting on the eastern boundary, at about 5ft south of the northeast corner of the area being covered, the surveyor will walk at a pace of about ½-meter/sec to the western boundary of the survey area while scanning the surface with the gamma detector, and listening for changes in meter click rate. The side-to-side motion of the detector should be such that the detector traverses the path from one side of the surveyor to the other in about 2 seconds. Upon reaching the western boundary, the survey team will move southward about 10-feet, then continue the survey while walking towards the eastern boundary of the survey area. The survey team will repeat these east/west transits until the gamma detector has been swept over the entire survey area. If an increase in gamma activity is noticed, the survey team will leave the east/west transit line temporarily, and follow the direction of the increase until the location of the peak is found. After the peak data is recorded, the survey team will return to the east/west transit line and continue their systematic search for more peaks.

For purposes of the walk-about survey:

An "**activity peak**" is defined as any location where the 1-m ambient gamma activity approaches 523 cpm above the normal background countrate for the area.[note 3] =[nominally,~3490 cpm]

A "**hot spot**" is defined as any location where the 1-m ambient gamma activity approaches 1075 cpm above the normal background countrate for the area.[note 4] =[nominally,~4040 cpm]

The countrates of any gamma activity peak or hot spot finds will be recorded, and the location identified by reference to the site location grid. To find the location of the peak or hot spot in terms of the site location grid, the survey team will lay

---

note 3: Minimum countrate difference for statistical significance,[ref 11] for gamma activity at 1-meter height, based on previous T886 survey data[ref 9] where background and standard deviation for the area were determined to be 2966 ± 225 cpm.

note 4: Based on a gamma countrate conversion factor of ~$\frac{1\ \mu R/hr}{215\ cpm}$

measuring tapes along the line of east/west grid reference stakes just north of, and just south of the location of the activity peak. Using a third measuring tape, running north/south (perpendicular) between the first two tapes, and through the location of the activity peak, the survey team will then be able to determine the [N/S , E/W] rectangular coordinates for the gamma activity peak or hot spot in terms of the SDF site location grid (refer to section §5.2.1). The survey team will record the location coordinates on a **Walk-About Survey Data Record** (figure B2, as described in Appendix §B.6.1), and enter the gamma activity measured at the surface at that location in the data column provided. A measurement of 1-meter ambient gamma activity, (using the *Ambient Gamma Detector Fixture*) will also be made at each peak/hot-spot location, and recorded in the appropriate columns of the data record.

After an "**activity peak**" is found in the walk-about survey, and the location and activity data have been entered on the data record, the crew will write a large "**P**" on a single iridescent yellow flag -- using a black marking pen -- and place the flag at that location. The Survey Manager will evaluate the finding to determine if the activity peak is due to the natural geology of the area; if it is not, the finding will be reported to the RP&HPS Supervisor, and to the Project Manager for further advisement.

After a "**hot-spot**" is found in the walk-about survey, and the location and activity data have been entered on the data record, the survey crew will determine the size of the hot-spot, and mark its approximate boundary with a ring of iridescent yellow flags. The site Crew Chief or Facility Manager will be notified before the end of the workshift, who will notify the site Health & Safety Officer (HSO), the Project Manager, and the Program Manager. The Program Manager will provide for additional sampling, as needed, at the location of the hot spot by the sample survey contractor.

5.3.2 AMBIENT GAMMA CHARACTERIZATION SURVEY INSTRUCTIONS

Ambient gamma characterization survey measurements will be made at each of the [N/S, E/W] intersects of the 10ft interval grid. The location of each survey measurement point will be determined by the grid layout procedures given in §5.2.2. The survey data to be obtained at each location on the 10ft interval grid, will be a measurement of ambient gamma activity at 1-meter distance from the ground surface, from each of the two independent gamma survey instruments. The measurements will be simultaneous, using a counting period of 1-minute. To assure reproducibility, the two detectors will be mounted on the *Ambient Gamma Survey Detector Fixture* (refer to section §A.1 for details about the survey fixture). All measurement data will be recorded on a Survey Data Control Sheet (figure B3, as described in Appendix §B.6.2).

5.3.2.1 Make sure that the function switch settings are correct (Appendix B.3), that the calibration date has been verified, that the instrument performance checks are current and satisfactory (Appendix B.4), and that the RP&HPS Instrument Qualification Report has been properly completed (Appendix B.5).

5.3.2.2 Set up the survey area with *east* and *west boundary tapes*, and with a *survey transect tape* as described in section §5.2.2.

5.3.2.3 Place the *Ambient Gamma Survey Detector Fixture* at the starting, or next, 10ft interval along the *survey transect tape*. During the measurement, the *fixture* pole will be held perpendicular to -- with the gamma detectors oriented towards -- the surface being measured. The gamma detectors must also be at least 1-meter distance from other nearby rocks or cliff faces.

5.3.2.4 Initiate a 1-minute count for the two instruments at the same time by pushing each of their respective **"COUNT"** buttons.

Record the results of the count measurement (for both instruments) on the Survey Data Control Sheet, next to the site location grid identification data. Add the date, time, and any pertinent notes about the measurement environment (ie: proximity to large rocks, temperature, weather, etc.), and any unusual behavior of the instruments.

Observe that the meter readings from the two duplicate instruments are consistent.

5.3.3 SURFACE SAMPLE SURVEY INSTRUCTIONS IN REMEDIATED AREAS

The sampling locations for each of the sample survey lots for the remediated areas of the site are described in section §5.2.3. All sampling will be done by a contract vendor. Protective eye glasses and face shield will be worn by the person(s) fracturing the samples from the rock-face.

Before collecting the surface sample, a gamma detector will be used to measure the gross gamma activity at the rock surface, and at 1-meter height above the sample location. The sample at each location will consist of residual soil, or rock chips broken off of the exposed bedrock. Sample handling will be organized so as to maintain its integrity throughout sample collection, packaging, identification and labeling, recording of origination data, and chain-of-custody management.[ref 7]

5.3.3.1 Sample Identification Numbers

The sample ID number is a three part number that identifies the sample in terms of the specific project; the collection year; and a consecutive identification number that refers to a listing in a sample logbook. The logbook listing contains the site location where the sample was taken, plus date, time, and identity of the collector.

For the SDF Final Survey, the sample ID number should begin with the code identifying the site (886-), followed by the last two digits of the sample collection year (1993-), and end with a consecutive listing number from the sample logbook (-nnnn). Thus, sample numbers for the T886 site will start with:

886-93-0001

5.3.3.2 Sample Location Data

The sample locations for Lot II are given in section §5.2.3.1; Lot III sample locations are given in section §5.2.3.2.

Enter the sample location, in terms of the site coordinate grid, in the columns provided on the **Sample Origination/Location Data Sheet** (figure B4, as described in Appendix §B.6.3). Before collecting the surface sample, measure the gross gamma activity at the bedrock surface, and measure the gross ambient gamma activity at 1-meter height above the sample location. Record these measurements on the data sheet, along with the ID number of the meter used for the measurement; also enter the time and date of the gamma measurement, and the initials of the person doing the work.

5.3.3.3 Sampling Tool Cleanliness

Sampling tools will be wiped with a clean, damp rag, or utility wipe before taking each sample, so as to minimize cross contamination between locations.

5.3.3.4 Sample Collection

Where residual soil is present, it should be taken as part of the sample; if there is enough residual soil to complete the sample, it is not necessary to take bedrock fragments. Where bedrock fragments must be taken, carefully break off chips of rock from the bedrock face, using the geologist's hammer, chisel, and pry-bar. It is important to wear safety goggles and a safety face-shield during this activity to prevent damage to the eyes or face from flying pieces of rock. The rock chips should be broken into small enough fragments for easy placement in a sample beaker.

Deposit the soil or rock sample in a clean 500ml sample beaker, filling the beaker to approximately 80% of capacity. Take care to prevent contamination of the beaker with extraneous dust and soil. Place a clean lid on the filled beaker, and seal the seam of the lid with plastic tape. Place the filled beaker inside a clean plastic bag.

5.3.3.5 Sample Identification and Origination Record Keeping

Assign a sample identification number to the sample, and enter the sample ID number on a **Sample Label** (figure 7); also enter the name of the collector, collection date and time, and the sample location. Affix the label to the side of the beaker. Affix a seal, bearing the sample ID number, to the seam of the lid in such a fashion that the lid cannot be removed without tearing the seal. Write the sample ID number on the outer plastic bag, using a permanent marking pen, and seal the bag with tape. Take care that the tape does not obscure the information on the **Sample Label**.

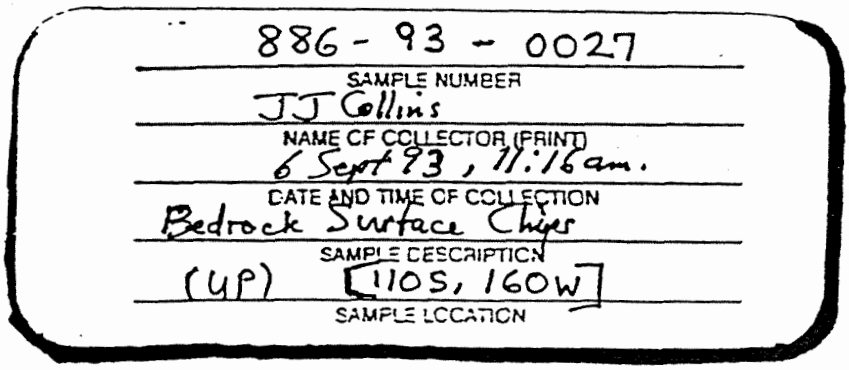

Figure 7 -- Sample Label.

Record the sample ID number on the **Sample Origination/Location Data Sheet** (figure B4). The person certifying the accuracy of the gamma measurements and sample ID data will then initial the entries in the column provided.

Enter the sample location, date, time, and name of the collector in the **Sample Logbook** under the sample identification number, as described in section §5.3.3.1.

5.3.3.6 Chain-of-Custody Management

Fill out a **Radiometric Analysis Request & Chain-of-Custody Record** (figure 8), and enter the sample ID number on a line of the form. The Chain-of-Custody record can be used to manage up to eleven samples. All of the samples being managed by a single Chain-of-Custody record should be kept together.

5.3.3.7 Sample Analysis Quality Assurance

Each shipment of samples to the selected analysis lab will include an additional 5% of duplicate samples, plus one trip blank consisting of deionized water.

Figure 8 -- Radiometric Analysis Request
&
Chain-of-Custody Record

ROCKETDYNE DIVISION

RADIATION PROTECTION AND HEALTH PHYSICS SERVICES DEPARTMENT

RADIOMETRIC ANALYSIS REQUEST AND CHAIN-OF-CUSTODY RECORD

SAMPLE		COLLECTION DATE	ANALYSIS REQUESTED								
			GROSS		γ			ISOTOPIC			
NUMBER	TYPE		α	β	SPEC	^{3}H	^{90}Sr	U	Th	Pu	OTHER

DESCRIPTION OF ITEM SAMPLED, LOCATION AND PURPOSE OF SAMPLE: _____

SAMPLE COLLECTOR: _____

(PRINT AND SIGN) DATE: _____

RECORD OF SAMPLE CUSTODY

NAMES OF CUSTODIANS (PRINT AND SIGN)	RECEIVED		TRANSFERRED	
	DATE	TIME	DATE	TIME

RESULTS REPORTED (TO AND HOW): _____

SAMPLE DISPOSITION (DESCRIBE): _____

6.0 SOIL SAMPLE ANALYSIS

All of the samples will be sent out to a contracted analysis lab for chemical and radiometric analysis. For this final radiological survey, the contract analysis lab will analyze the samples to determine the isotopic concentrations of the radioisotopes listed in Table 3. For quality assurance, all sample shipments will contain at least 5% sample duplicates, plus one trip blank of deionized water.

Table 3 -- Soil Sample Radioisotope Analysis Requirements for Release of SDF Land to Unrestricted Use.[ref 3]

Gamma Spectrometry	^{137}Cs ^{134}Cs ^{60}Co	^{152}Eu ^{40}K ^{125}Sb	^{241}Am ^{235}U ^{226}Ra
Tritium*	^{3}H		
Isotopic Uranium	^{234}U	^{235}U	^{238}U
Isotopic Plutonium	^{238}Pu	$^{239}Pu/^{240}Pu$	
Isotopic Thorium	^{230}Th	^{232}Th	
Strontium	^{90}Sr		

* Analysis for tritium must be performed using EPA method 906.0, including re-distillation of water after extraction from the soil.

7.0 RESRAD ANALYSIS

Analysis of the soil samples from the sample survey will provide the isotopic concentration data needed for performing environmental pathway exposure/dose analysis with RESRAD.

RESRAD (Residual Radioactive Material Guideline) is a computer analysis program to calculate the estimated radiation dose from a site through various assumed exposure pathways.[ref 12] The RESRAD code was developed by US DOE specifically for performing pathway analysis for land to be released for use without radiological restrictions. Environmental pathway analysis calculates the various contributions to dose from direct radiation exposure, inhalation, and ingestion for various land uses ranging from wilderness to residential. The code calculates the radiation dose to a target person in mrem/yr, using the radioisotope concentration data, in pCi/g, derived from analysis of the sample survey.

RESRAD analysis will first be used to determine the appropriate guideline limits for the fractional concentrations of any radioisotopes identified in the sample survey. Given a ratio of the relative concentrations of a mix of radioisotopes, RESRAD will be used to calculate the specific maximum concentrations that could be present for each isotope if the total radiation dose from the site is less than the 10 mrem/yr limit established for this project.[ref 3] The actual radioisotope concentration data from the sample survey will then be compared to these calculated concentration maximums to determine that none of the residual radioisotope concentrations exceed the limits.

RESRAD will next be used to estimate the total radiation dose that could be received from the site, based upon the actual concentrations of man-made radioisotopes still present in the soil, if any. The radiation dose estimate calculated for the site will be compared to the acceptance criteria limit stipulated in reference 3 as acceptable for release without radiological restrictions. Reference 3 stipulates an acceptance criteria of <10mrem/yr, which is a factor of 10 below the basic dose limit of 100mrem/yr recommended as acceptable for release in US DOE Order 5400.5, Chapter IV.[ref 13 & 14]

APPENDIX A: SPECIAL HARDWARE PREPARATIONS

A.1 AMBIENT GAMMA SURVEY DETECTOR FIXTURE

In order to assure reproduceability of the survey measurements in the ambient gamma characterization survey, the sodium iodide detectors will be mounted on a lightweight PVC fixture. This fixture, shown in figure A1, holds the two detectors side-by-side, oriented towards the ground at 1-meter height. Its use will facilitate quick placement of the detectors at each measurement location, while eliminating errors due to detector distance or orientation. The fixture has a removeable spike, at the ground contact end, that can be pushed into the soil to hold the pole erect; this allows one person to manage the detector placement and meter operation, while a second person manages the survey data entries and logbook notations.

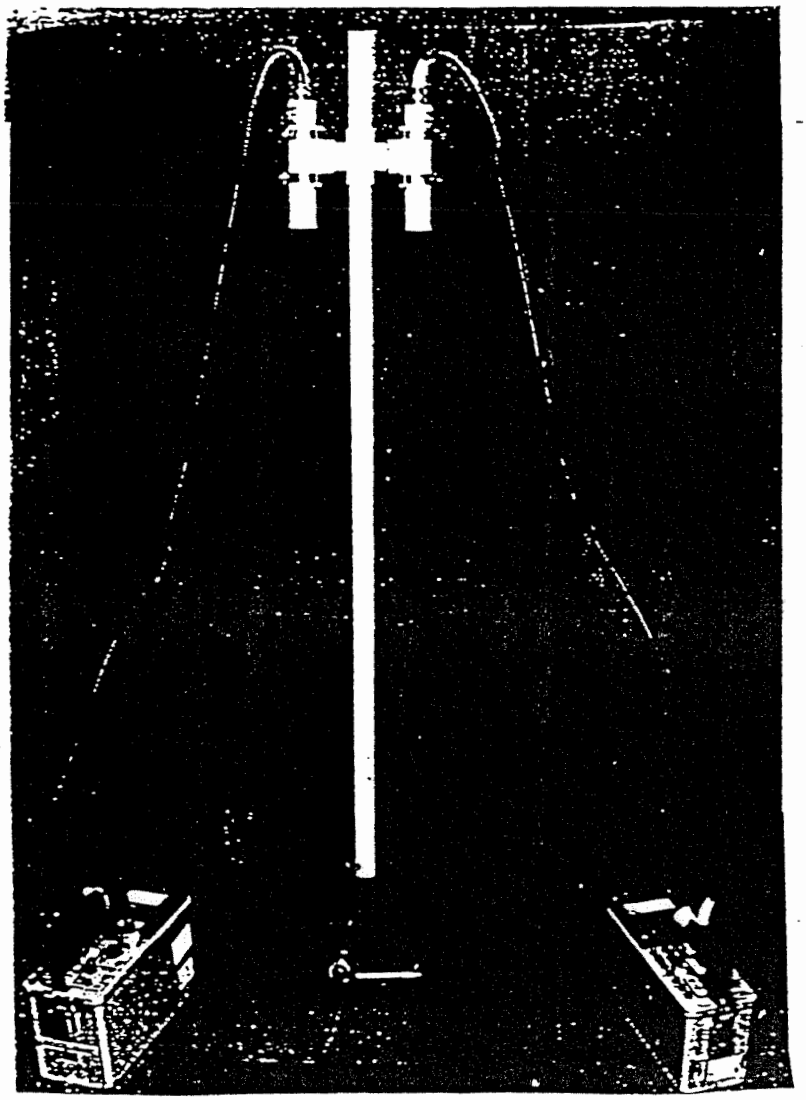

Figure A1. Ambient Gamma Survey Detector Fixture.

A.2 WALK-ABOUT SURVEY DETECTOR FIXTURES

During the walk-about survey, the sodium iodide detector will be mounted at the end of a balanced boom, so the surveyor can sweep the detector over a large area while walking along the survey path. The fixture for this survey, shown in figure A2, has a length of PVC pole for the boom, with a bracket at one end to hold the detector upright with respect to the ground. A shoulder strap is attached to the approximate balance point of the fixture, so the surveyor can shoulder the weight while walking forward. The arrangement allows the surveyor to sweep the detector over an area about 10 feet wide while standing in one place, or walking a straight line. Two of these fixtures should be manufactured so that two gamma detectors can be in use at the same time.

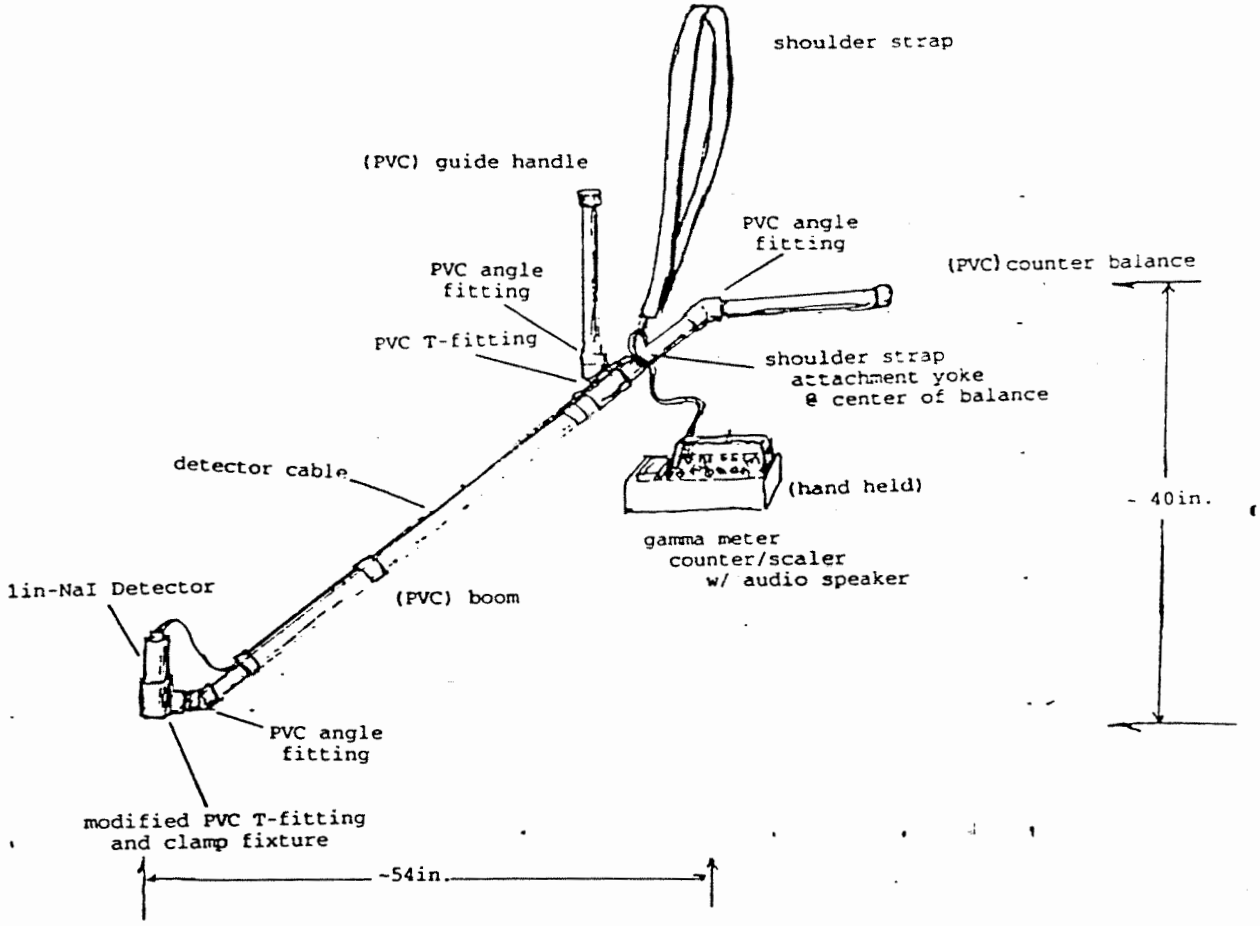

Figure A2. Walk-About Survey Detector Fixture.

APPENDIX B: INSTRUMENT OPERATION AND QUALITY ASSURANCE PROCEDURES

B.1 QUALITY ASSURANCE OVERSIGHT

ETEC Quality Assurance and Training department will provide independent QA oversite to assure effective execution of the requirements of this final survey procedure through monitoring and surveillance of activities listed in Appendix B.

B.2 SURVEY INSTRUMENT QUARTERLY CALIBRATION

All survey instruments used in this study will be selected from among those maintained on a Quarterly Calibration cycle by the RP&HPS Instrument Lab. Further, the date of the last calibration for the selected instruments shall be no more than 45 days preceding the start date for the SDF final survey .

The NaI gamma survey meters will be calibrated against a ^{137}Cs standard source, and verified against both ^{241}Am and ^{226}Ra standard sources.

A copy of the Calibration Lab's Instrument Calibration report will be included with the historical file for this project.

B.3 SURVEY INSTRUMENT OPERATING PROCEDURES

This section provides detailed instructions for calibration and use of the survey instruments.

Note: All non-normal observations and meter readings shall be reported to the survey manager.

B.3.1 INSTRUMENT SETTINGS

For the Model 2220 and 2221 Ratemeter/Scalers:

WINDOW ..... "OUT"
RESP (F/S) ..... "F"
*** RANGE ..... "x10"**
*** COUNT TIME:**
MINUTES ... "1.0"
x1/x10 ... "x1"

* (Normal background settings are shown; set as needed.)

Additional settings for the model 2221:

SCALER/DIG RATE ..... "SCALER"
LAMP ON/OFF ..... "OFF"
AUDIO DIVIDE ..... "1"
MINUTES ..... "1"

B.3.2 INSTRUMENT TURN-ON PROCEDURE

The following procedure should be followed whenever the instrument has been left unused for more than an hour.

B.3.2.1 Set the **RANGE** switch to **"LOG"**; for the model 2221, also set the **POWER ON/OFF** switch to **"ON"**.

Observe that the analog meter pointer goes to maximum off-scale, then drops back to some mid-scale location.

B.3.2.2 Set the **RANGE** switch to the *normal* background setting.

B.3.2.3 Check the **battery condition** by pushing the **"BAT"** button.

Observe that the digital display reads from 5.8 to 6.4 volts.

B.3.2.4 Check the **high voltage** supply by pushing the **"HV"** button.

Observe that the displayed reading is within +/- 25 (volts) of the value indicated on the calibration lab label (affixed to the side of the instrument).

B.3.2.5 Check the **threshold** setting by pushing the **"THRESH"** button.

Observe that the displayed reading is within +/- 25 of the value indicated on the calibration lab label.

B.3.2.6 Check the instrument's response to normal background radiation. Remove the instrument from known radioactive sources, and initiate a 1-minute background radiation count by pushing the **"COUNT"** button.

Verify that the resulting meter reading is within normal bounds: (2200 to 3700 counts/min for ambient outdoor gamma at 1 m height).

B.3.2.7 The instrument is now ready for use. If the current daily Functional Performance Checks have not been completed, proceed to section B.4 before performing survey measurements.

B.4 DAILY FUNCTIONAL PERFORMANCE CHECKS

To ensure that data quality is sustained throughout the final survey of the SDF site, checks on survey instrument functional operation will be performed at the start of each shift, at the middle of the shift, and at the end of the shift. Additional performance checks may also be done whenever needed by the survey team.

NOTE 1:
Before starting the SDF final survey, the survey team will select a location near the SDF Site that is out of the way of the work activities, free of contamination, and representative of the normal background radiation level for this geological area. This location will be the designated spot for the daily **Instrument Performance Checks**, and should be disturbed as little as possible while the SDF final survey is in progress. Radioactive sources will be kept away from this location (no closer than the HP Trailer) except when the survey instruments' responses to the field check source are being checked.

NOTE 2:
Daily **Instrument Performance Checks** will always be done at the designated instrument check location near the SDF site.

NOTE 3:
Completion of the daily **Instrument Performance Checks** is documented on the signed Instrument Qualification Report (**IQR**) shown in figure B1, and described in appendix §B.5.

B.4.1 AMBIENT BACKGROUND LEVEL RESPONSE TEST

B.4.1.1 At the beginning of each work shift the survey team will check the **"calibration due"** date (on the calibration label affixed to the side of the instrument) to verify that the instrument calibration is still current.

Record the calibration due date on the IQR.

Carry the survey instruments to the location designated for daily checks. Using the *Ambient Gamma Survey Detector Fixture*, place the two gamma detectors so they are side by side at 1-meter height, oriented towards the ground.

B.4.1.2 Turn on the instruments, and check that the instrument voltage readings are within normal bounds.

Record the meter readings on the IQR.

B.4.1.3 Initiate a 1-minute count for both of the gamma instruments at the same time by pushing each of their respective **"COUNT"** buttons.

Record the results of the 1-minute count (for both gamma instruments) in the IQR.

Verify that the resulting meter readings are within normal bounds: (2200 to 3700 counts/min for ambient gamma at 1-m).

B.4.1.4 Repeat step B.4.1.3 for a total of two measurements of 1-minute count data.

B.4.2 FIELD CHECK-SOURCE RESPONSE TEST

Normal instrument responses to ambient background should be verified before proceeding. Check source response of the two gamma detectors should be checked together while still mounted on the *Ambient Gamma Survey Detector Fixture*, at 1-meter height, oriented towards the ground.

A low-level, ^{137}Cs calibration source will be used as the field check source. The source ID number and gamma activity will be entered on the IQR, and the method that was used to evaluate the source's isotope content in the laboratory will also be noted.

B.4.2.1 Place the check source on the ground at the base of the survey fixture.

B.4.2.2 Initiate a 1-minute count on both instruments at the same time by pushing each of their respective **"COUNT"** buttons.

Record the results of the 1-minute count (for both gamma instruments) in the IQR.

B.5 INSTRUMENT QUALIFICATION REPORT (IQR)

The Instrument Qualification Report (IQR) is the document that is used to record the results of instrument performance checks. As such, it is the central quality assurance thread that traces the performance of the survey instruments, in quantitative terms, throughout the entire survey.

The IQR form is shown in Figure B1. One IQR form will be completed for each instrument used during each day of the survey. The IQR forms will be permanently attached to the survey log book at the beginning of each survey team work shift, and the results of performance checks will be entered on the IQR forms at least three times each shift: at the beginning of the work shift; at mid-shift; and at the end of each work shift. The performance checks will always be made at the designated instrument check location, near the SDF site (established in section §B.4).

Whenever instrument performance checks are entered onto the daily Instrument Qualification Report, a notation remark about the check will be entered in the next available row on the Data Control Sheet currently being used.(see section §B.6).

B.5.1 SPECIAL INSTRUCTIONS FOR COMPLETING THE IQR

B.5.1.1 At the start of each work shift, the survey manager will provide the survey team with copies of the daily Instrument Qualification Reports (IQRs). The survey team leader will verify that a correct form has been provided for each instrument used in the survey. Identification data for the instrument electronics and detector hardware will be completely entered. Copies of the forms with completed manufacturer and RI asset ID data, **Scaler Diagnostic CAL** values, and **Field Check Source** ID data may be prepared in advance.

B.5.1.2 The Survey Team Leader will affix the IQRs to the survey log and finish adding any of the preliminary entries needed.

B.5.1.3 The instrument meter readings from each work shift performance check will be entered onto the IQRs, starting with the checks at the beginning of the work shift. The clock time when the check is started will be entered at the top of the column.

Compare the instrument voltage readings obtained from the performance check with the **CAL** values entered for each instrument, and verify that the measured values are within tolerance.

Figure B1. Daily Instrument Qualification Report

RADIATION PROTECTION & HEALTH PHYSICS SERVICES
GAMMA DAILY INSTRUMENT QUALIFICATION REPORT

INSTRUMENT ELECTRONICS

RI#:_____ S/N:_____

MFR:_____ Mdl:_____

RADIATION DETECTOR

RI#:_____ S/N:_____

MFR:_____ Mdl:_____

(Cal-Lab) Detctr Norm Fctr:_____

CALIBRATION

Last Calibrated:_____ Next Cal Due:_____

FIELD CHECK SOURCE

Source ID:_____

Verify By:_____

Isotope Activity

INSTRUMENT QUALIFICATION DATA

	@Shift Start:	@Mid-Shift:		@Shift End:
Check Time:	_____	_____	_____	_____
SCALER DIAGNOSTICS				
(CAL) ( ) BAT:	_____	_____	_____	_____
( ) HV:	_____	_____	_____	_____
( ) THRSH:	_____	_____	_____	_____
BACKGROUND RESPONSE				
1-Min Count:	_____	_____	_____	_____
:	_____	_____	_____	_____
:	_____	_____	_____	_____
Calc Avg cpm:	_____	_____	_____	_____

CHECK-SOURCE RESPONSE Expctd 1-min Count: _____ cpm

Measured 1-Min Count:	_____	_____	_____	_____
:	_____	_____	_____	_____
:	_____	_____	_____	_____

DAILY AVERAGES

Check Source Response:

Avg Chk Src Cnt: _____+/-_____ cpm

Ambient Background Response:

Avg Bkgd cnt: _____+/-_____ cpm

[x 0.00465 $\frac{\mu R/hr}{cpm}$]

Avg Bkgd Exposure: _____+/-_____ $\frac{\mu R}{hr}$

Certified By: Date: Project: SDF (T886) Final Survey

Compare the count values from the **Background Level Response Test** to the expected value for each instrument, and verify that the measured values are within normal bounds. Calculate the average of the two 1-minute counts and enter the result on the IQR.

Compare the 1-minute count values from the **Check-Source Response Test** to the expected count value for each instrument, and verify that the measured value is within normal bounds.

B.5.1.4 The person performing the daily instrument performance checks and evaluating the results will document the fact by signing and dating the IQR.

B.5.2 INSTRUCTIONS FOR DAILY EVALUATION OF THE IQR DATA

B.5.2.1 Before the beginning of each work shift, the survey manager will inspect the data from the previous day's Instrument Qualification Reports to determine that there are no anomalous entries.

B.5.2.2 Also, for each instrument, using the data from the previous day's IQRs, the Survey Manager will calculate the mean and standard deviation for all of the:

1-minute Ambient Background Response Checks
1-minute Check Source Response Checks

The results will be plotted against elapsed survey days on survey management control charts, ("DAILY MEANS" control charts), throughout the duration of the survey. These charts will be monitored by the Survey Manager to watch for trends in instrument performance, as evidenced by trends in the IQR data.

B.6 SURVEY DATA CONTROL SHEETS

B.6.1 WALK-ABOUT SURVEY DATA RECORD

The Walk-About Survey Data Record will be used to record the location of peaks and potential hot spots discovered during the walk-about survey of near-surface gamma activity. If a peak or hot-spot is discovered in the survey, the surveyor will identify the location in terms of the site location grid, and enter the location coordinates on the walk-about survey record. Space is also provided for entering the results of the surface gamma, and 1-meter ambient gamma activity measurements at the hot-spot location. The surveyor will also enter the date and time of the measurements, enter any observations about the location, or the behavior of the meters, and complete the enter their initials in the right hand column.

Page:_____of_____

SDF FINAL RADIOLOGICAL SURVEY
WALK-ABOUT SURVEY DATA RECORD

NORTH/SOUTH LOCATION COORDINATE	WEST LOCATION COORDINATE	SURFACE GAMMA ACTIVITY	meter no.	AMBIENT GAMMA ACTIVITY AT 1-M meter#G1 gamma	meter#G2 gamma	METER/LOCATION NOTES	date:	time:	HP INIT'L

Survey Completed By:_____ _____

:_____ _____

Figure B2 T886 Walk-About Survey Data Record

B.6.2 1-m AMBIENT GAMMA CHARACTERIZATION DATA RECORD

The T886 1-m Ambient Gamma Characterization Data Record, Figure B3, will be used for recording all ambient gamma survey data from the SDF Final Radiological Survey. Each measurement at an individual sample location in the survey will occupy one row of the Survey Data Control Sheet. Each row of the sheet has columns for entering the survey location (defined by the 10ft interval grid), gamma activity measurements from each of the two gamma survey instruments, date and time of day, plus notes about the measurement environment at the location, and about any anomalous instrument behavior. The person taking the measurements will certify their adherence to the procedures in this document by entering their initials in the right hand cloumn of each line.

Each survey team member who takes survey measurements (ie: whose initials appear on a data entry line), will enter their name and initials at the bottom of the data record sheet.

B.6.3 SAMPLE ORIGINATION/LOCATION DATA RECORD

NOTE: This data record is provided for use by the contractor performing the surface sampling in the T886 remediated areas.

The T886 Sample Origination/Location Data Record, figure B4, should be used to record information about the point of origination for each sample taken in the surface sample survey. The sample data record provides space for entering the sample location (in terms of the site location coordinates); 1-m ambient gamma, and surface gamma activity (in cps) at the sample location; notes about unusual sample color or odor; the sample identification number (from the T886 Sample Control Log Book, as mandated in reference7); name of the person collecting the sample; and time & date of collection. Each Sample Origination/Location Data Record has space for recording information about 19 samples. Completed sample origination data records should be forwarded to the T886 Final Radiological Survey Manager from RP&HPS (D/641-373).

B.7 SURVEY LOG BOOK

A survey log book will be maintained throughout the duration of the T886 final radiological survey (not to be confused with the T886 Sample Control Log Book). Pertinent notes and explanatory comments about the survey will be entered in the log book to aid in later interpretation of the survey results. The daily **Instrument Qualification Reports** (section §B.5) will be affixed to the survey log book at the end of the work day. All measurement data from the survey will be entered on the appropriate **Survey Data Control Sheets** (section §B.6), which will also be affixed to the log book as each data sheet is filled up.

Figure B3. 1-meter Ambient Gamma Characterization Data Record

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SDF FINAL RADIOLOGICAL SURVEY
1-METER GAMMA CHARACTERIZATION DATA RECORD

NORTH/SOUTH LOCATION COORDINATE	WEST LOCATION COORDINATE	DATE	TIME	AMBIENT GAMMA at 1-meter Height G1 GAMMA @ 1-m	AMBIENT GAMMA at 1-meter Height G2 GAMMA @ 1-m	METER/LOCATION NOTES	HP INIT'L

Survey Completed By:_____ _____

:_____

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T886 FINAL RADIOLOGICAL SURVEY
SAMPLE ORIGINATION/LOCATION DATA RECORD

NORTH/SOUTH LOCATION COORDINATE	EAST/WEST LOCATION COORDINATE	DATE	TIME	AMBIENT GAMMA @ SAMPLE LOCATION at surface:	AMBIENT GAMMA @ SAMPLE LOCATION at 1-meter:	METER / LOCATION NOTES	SAMPLE ID NUMBER	HP INIT'L

Sample Origination/Location Data Certified By: _____ _____

:_____ _____

Figure B4. Sample Origination/Location Data Record